

THREE NEW SPECIES OF *CRATAEGUS* (ROSACEAE)
FROM WESTERN NORTH AMERICA:
C. OKENNONII, *C. OKANAGANENSIS*
AND *C. PHIPPSII*

J.B. PHIPPS

*The University of Western Ontario
Department of Plant Sciences
London, Ontario, CANADA N6A 5B7*

R.J. O'KENNON

*Botanical Research Institute of Texas
509 Pecan Street
Fort Worth, TX 76102-4060, U.S.A.*

ABSTRACT

Three new species of *Crataegus*, *C. okennonii* J.B. Phipps (from series *Douglasianae*), *C. okanaganensis* J.B. Phipps & O'Kennon (from the newly described series *Purpureofructi* J.B. Phipps & O'Kennon), and *C. phippsii* O'Kennon (near series *Molles*) are described from western North America. All are striking, widespread taxa with a substantial number of records.

KEY WORDS: Taxonomy, *Crataegus*, Rosaceae, new species

RESUMEN

Tres nuevas especies de *Crataegus*, *C. okennonii* J.B. Phipps (de la serie *Douglasianae*), *C. okanaganensis* J.B. Phipps & O'Kennon (de la nueva serie descrita *Purpureofructi* J.B. Phipps & O'Kennon), y *C. phippsii* O'Kennon (próximo a la serie *Molles*) se describen del oeste de Norte América. Todos son taxa sorprendentes y de amplia difusión con un sustancial número de citas.

Recent fieldwork with R.J. O'Kennon of Fort Worth, Texas in the American states west of the Rocky Mountains and in British Columbia for the first author's revision of the red-fruited *Crataegi* (Phipps 1998) of this region has serendipitously uncovered three new species of hawthorn. The first, *Crataegus okennonii*, a new purplish-fruited taxon of ser. *Douglasianae* (Rehd. ex Sarg.) Rehd., striking and obvious in the field, is also usually easily resolved in the herbarium. *Crataegus okanaganensis*, rarely collected before our studies, is also a striking new taxon with brilliant red (late August) to deep purple (late September) fruit. It is accorded a new series, *Purpureofructi*, together with the long-described and long-overlooked *C. williamsii* Eggl. The third new species, *C. phippsii*, though first collected as far back as 1908, remained otherwise unnoticed until our fieldwork. It is a very distinct purple-fruited species related to series *Molles*.

One of the reasons that these new *Crataegus* species west of the Rocky Mountains have been overlooked has been the failure of nearly all collectors to take note of fruit color (Phipps 1998). Each of the following species is quite distinct in this respect and we therefore take the opportunity to present color plates of the three species illustrating this point. Hawthorns are considered to have mostly black or red fruit. The discovery of these three extends the number of those which are burgundy to deep purple at some stage in their development. Another feature emerging from this work are new centers of diversity for western North American *Crataegus* appearing in the northern Okanagan of British Columbia and northwest Montana.

A further reason that these taxa have been overlooked is that in the Pacific Northwest region (to nw Montana) and British Columbia where they occur there has been a belief that generally, only one red-fruited native species, *C. 'columbiana* Howell,' one black-fruited native taxon, *C. douglasii* Lindl. (incl. *C. suksdorfii* (Sarg.) Kruschke) and one introduced red-fruited taxon (*C. monogyna* Jacq.) occurred. This belief has persisted (Phipps 1998) in spite of the widespread presence in this region of *C. macracantha* Lodd. ex Loud. In view of this lack of taxonomic inattention, including the disappearance from the floristic literature of the distinctive *C. williamsii*, it is perhaps not surprising that earlier botanists did not recognize potential new taxa in this region. Consequently, we take this opportunity of reviewing the main western North American species (west of the Rocky Mountains) in a numerical taxonomic analysis. This analysis uses one synthetic OTU per taxon, each described from typical material over 38 morphological characters (Table 1) of the kind commonly used in *Crataegus* taxonomy. The eleven native species generally recognized in the west are all present, together with *C. monogyna*, a useful outgroup, and five species from east of the Rocky Mountains (*C. mollis* (Torr. & A. Gray) Scheele, *C. submollis* Sarg., *C. brachyacantha* Sarg. & Engelm., *C. schuettei* Ashe and *C. punctata* Jacq.) to give structure and scale. Also the three new taxa described in this paper are included. A dendrogram was prepared by NT-SYS using the options taxonomic distance and unweighted pair-group arithmetic averaging. The results (Fig. 1) place *C. monogyna* and *C. punctata* outside all the other species. Among results of general interest, varieties (*C. chrysocarpa* Ashe var. *chrysocarpa* and *C. c. var. piperi* (Britton) Kruschke) cluster at about the 0.6 level while distinct species cluster at the 0.8 or greater level, e.g. *C. schuettei* and *C. woottoniana* Eggl. (series *Tenuifoliae*), *C. suksdorfii* and *C. douglasii* (series *Douglasianae*) and *C. erythropoda* Ashe and *C. rivularis* Nutt. (series *Cerrones*). Other pertinent results are discussed under the new taxa described in this paper.

TAXON DESCRIPTIONS

1. *Crataegus okennonii* J.B. Phipps, sp. nov. (Fig. 2). TYPE. CANADA.

TABLE 1. The 38 characters scored for the numerical taxonomic analysis.

<i>Plant, general</i>	<i>Inflorescence</i>
1. Plant habit	22. Flower: number
2. Bark type	23. Pedicel: pubescence
3. Branch arrangement	24. Anthesis time
<i>Thorns and Twigs</i>	<i>Flower</i>
4. Thorns: indeterminate present?	25. Diameter
5. Thorns: length	26. Calyx lobes: margins
6. Thorns: curvature	27. Stamen: no.
7. Thorns, color: browns	28. Anther: color
8. Thorns, color: gray	29. Style: number
9. Twigs, 1 yr old, color: browns	<i>Fruit</i>
10. Twigs, 1 yr old, color: gray	30. Fruit: color, month before full ripeness
<i>Leaf</i>	31. Fruit: color at full ripeness
11. Lamina: length	32. Fruit: shape, 1
12. Lamina: length/breadth	33. Fruit: shape, 2
13. Lamina: position of widest part	34. Fruit: pubescence
14. Lamina: venation, number	35. Fruit: calyx orientation
15. Lamina: veins to sinuses	36. Fruit: length (height)
16. Lamina: lobe number	37. Pyrenes: lateral faces
17. Lamina: lobe shape	<i>Autumnal foliage</i>
18. Lamina: max. sinus depth (LII)	38. Color
19. Lamina: abaxial pubescence, young	
20. Petiole: glands	
21. Leaf teeth: glands	

BRITISH COLUMBIA: Okanagan Valley, E side of 97A 0.5 mi N of intersection with 97, scrubby slopes with long cleared area, 50°21'N, 119°15'W, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6998 (HOLOTYPE: UWO; ISOTYPES: BRIT, CAN, TRT, US).

Frutices grandes vel arbores parvae, plerumque trunco uno, ad 10 m alti, spinosi; ramuli unius anni nitentes atro-castanei, ramuli veteriores brunneo-cinerei; spinac plerumque < 2.0 cm longae, crassae, plus minusve recurvatae, in juventute brunnae nitenter. Folia decidua; petioli plerumque 1–2 cm longi; laminae 4–6 cm longae, ellipticae vel late-ellipticae, interdum aliquantrum anguste ovatae vel rhombeae, paribus 4 venarum secundariarum longiorum vel aliquando non-lobatae vel vix-lobatae vel vadositer 2–3(–4) lobatae per latus, marginibus serratis, ± coriaceae, in maturitate tenuiter appresso-pubescentes supra, subter ± glabrae venis exceptis, colore autumnali prunino ad carmineum vel pallide carmineum. Inflorescentiae 12–20 floratae, bracteolis parvis caducis glandulo-marginatis, glabrae vel raro pubescentes. Flores 15–20 mm diam.; hypanthium glabrum extrinsecus; lobi calycis 3 mm longi, obscure glanduloso-marginati; petala ± circularia; sramina 10–12, antheris pallide roseis; carpelli et styli 3–4. Fructus ampulliformo-orbiculares, ca 10 mm diam., triste-purpurei vel nigri subinde in maturitare, in mense Augusto rubro-vinosi vel spadiceo-castanei, reliquiis calycis parvis; pyrenae 3–4, vadositer sulcatae dorsaliter, lateribus cum foveis vel interdum planis.

Large bushes or small trees, usually single-trunked, up to 10 m tall, thorny; one year old twigs deep shining mahogany, older branches gray/brown; thorns usually < 2.0 cm long, stout, slightly recurved, shiny brown when young. Leaves deciduous; petioles usually 1–2 cm long; blades elliptic to broad-

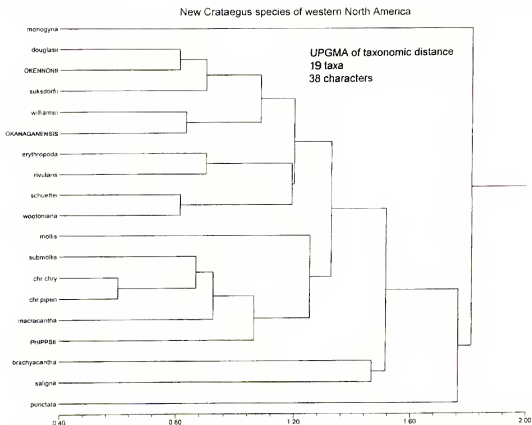


FIG. 1. Dendrogram of western North American *Crataegus* taxa showing relationships of species described in this paper. Newly described taxa in capitals. See text for more information.

elliptic, sometimes somewhat narrow ovate or rhombic, 4–6 cm long, with four pairs of longer secondary veins, barely lobed to shallowly 2–3(–4) lobed, the margins also serrate, somewhat coriaceous, at maturity finely appressed-pubescent above, below \pm glabrous except on the veins; autumnal color plum to crimson or light crimson. Inflorescences 12–20 flowered, with small caducous gland-margined bracteoles, glabrous to rarely shortly pubescent. Flowers 15–20 mm diam.; the hypanthium externally glabrous; calyx lobes 3 mm long, obscurely gland-margined; petals \pm circular; stamens 10–12, anthers pale pink; carpels and styles 3–4. Fruit \pm ampulliform-orbicular, ca. 10 mm diam., dull-purple or occasionally black at full maturity, red-burgundy to chestnut or reddish-brown in August, calyx remnants small; nutlets 3–4, shallowly grooved dorsally, sides variably eroded or sometimes plane.

Distribution.—*Crataegus okennonii* is fairly common in southern interior British Columbia and the eastern half of northern Washington, ranging to Idaho and nw Montana (Fig. 3), usually along streams or other sources of water. It is a tall distinctive plant, usually with a straight trunk, easily recognized in the field both in flower and in fruit. This new species is most closely related to *C. douglasii*, sens. str., from which it differs in fruit shape

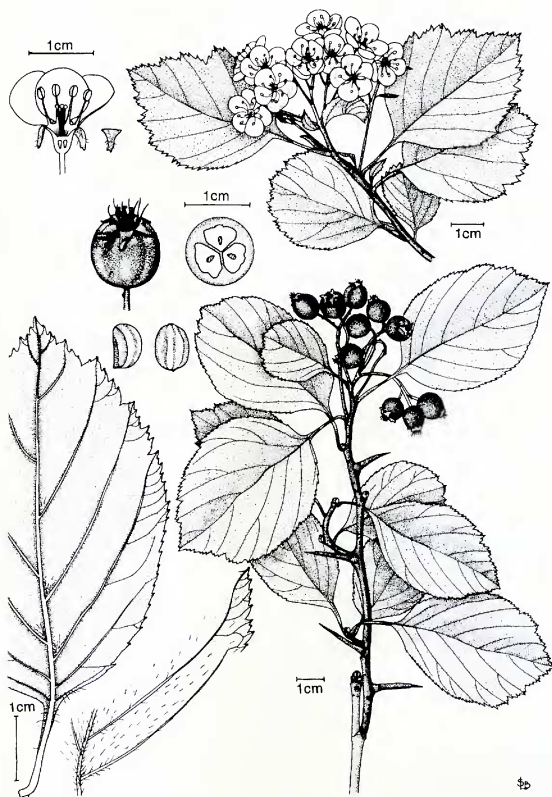


FIG. 2. Line drawing of *C. okemnonii* J.B. Phipps. Inflorescence, flowers and parts from *Phipps* 6959 (UWO); infructescence, fruit and parts from *Phipps* 6991, 6995 and *O'Kennon* (UWO). Scale bars = 1 cm.

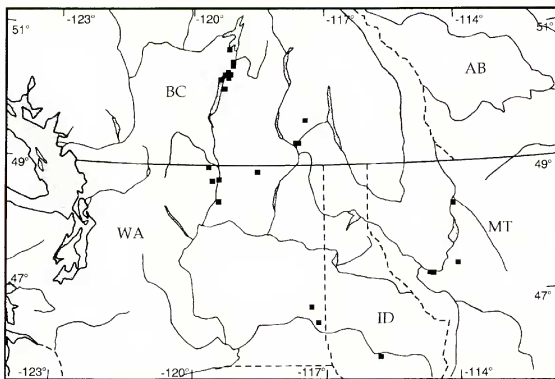


FIG. 3. Distribution map of *C. okennonii* J.B. Phipps.

and color, flower size, color of mature leaves (often yellowish-green), habit, thorn length, leaf shape and autumnal color of foliage.

Crataegus okennonii is one of a small group of 'black-fruited' (fruit \pm black at full maturity) species comprising series *Douglasianae* (Rehd. ex Sarg.) Rehd. which I restrict to *C. douglasii* Lindl., its immediate relative *C. suksdorfii* and the new species described here. A greatly widened concept of *C. douglasii* which includes *C. saligna* Greene and *C. rivularis* is advocated by Welsh (1982) and Holmgren (1997) but in my opinion this cannot stand up due to many significant differences in leaf-shape, venation type, bark and thorn type. Moreover intermediates do not exist between *saligna-rivularis* and *douglasii-okennonii-suksdorfii*. Difficulties for the broad concept are also emphasized by the fact that *C. saligna* (called *C. douglasii* Lindl. var. *duchesnensis* Welsh by Holmgren) has 20 stamens and cream anthers, contrary to the Intermountain Flora. I am (JBP, 199X) therefore placing *C. saligna* and *C. rivularis* in a different grouping.

Crataegus okennonii is a clearly defined segregate of *C. douglasii* differing by a considerable number of correlated characters of which thorn length (the shortest in series *Douglasianae*) and flower size (largest in the series) are the most unambiguous. The following couplet separates *C. okennonii* from the restricted interpretation of typical *C. douglasii* as found in western Canada and the adjacent United States.

1. Usually tree-like with a straight trunk, 5–10 m tall; young twigs deep glossy purple-brown; thorns usually 1.5–2 cm long; flowers ca. 15–20 mm diam.; fruit crimson lake or chestnut-colored in late August, becoming deep plum-black at maturity, not bloomy, broadly ampulliform; autumnal foliage usually crimson, plum or pale shades of same; styles and nutlets usually 3. *C. okennonii*
1. Usually bushy, though often large, not conspicuously single or straight-trunked, 3–8 m tall; thorns often longer, to 2.5(–3) cm long; young twigs mid to deep glossy brown, only occasionally as dark as *C. okennonii*; flowers often 12–15 mm in diam.; fruit variably colored in late August though never chestnut, shape ellipsoid or suborbicular; autumnal foliage color often bronzy, not consistently ± crimson or paler; styles and nutlets 3–5. *C. douglasii*

The differences between *C. okennonii* and a somewhat restricted *C. douglasii* are not by any means large but recognition at the specific level is also supported by the numerical analysis (Fig. 1), the lack of intermediates among good quality specimens both in the field and herbarium and the consequent immediacy of recognition. A more elaborate comparison with *C. douglasii* in which detailed leaf shape comparisons will be used may be expected consequent on the publication of R. Dotterer and T.A. Dickinson's detailed biosystematic studies of *C. okennonii* and *C. douglasii*.

It is possible that *C. okennonii* is the same as *C. douglasii* f. *badia* Sarg. (1907), a taxon in which the fruit is described as "chestnut", certainly not a common color in ripening fruit of section *Douglasii*. However, some of the unripe fruit of *C. okennonii* seen by us certainly was the color of reddish-brown, highly polished, shoe leather. Piper, the original collector of forma *badia*, variously described the fruit as brown, dark shining brown, chestnut, etc. Forma *badia* is a taxon systematically disregarded in the floristic literature. Both color changes during the ripening of western North American *Crataegus* fruit and the final color of the autumnal foliage have been poorly understood (Phipps 1997) as taxonomic characters so we wish to record them here. *Crataegus douglasii* fruit is shown in Figures 4d and 4e. The latter, photographed in August, illustrates the black, pendant, ellipsoid fruit while the other is another British Columbia specimen showing plenty of bloom. Figures 4a–4c illustrate *C. okennonii*, plate 4a showing the late August "chestnut" color while Figure 4b is a later version of the same color. Figure 4c shows the final, near ripe color, in late September, close to that of *C. douglasii*. The foliage is frequently a distinctive bright pale crimson color in late September as is shown in Figure 4f. Variation in leaf form of *C. okennonii* tends to fall into two classes, both illustrated in Figure 2, there being a broader, somewhat rhombo-deltoid, distinctly lobed form (Fig. 4a) and a more elliptic or narrow-ovate, shallowly lobed shape (Fig. 4b). *Crataegus okennonii* also bears conspicuous, expanding, caducous, coral-red bud scales.

I (J.B.P.) am pleased to name this distinctive and handsome new species

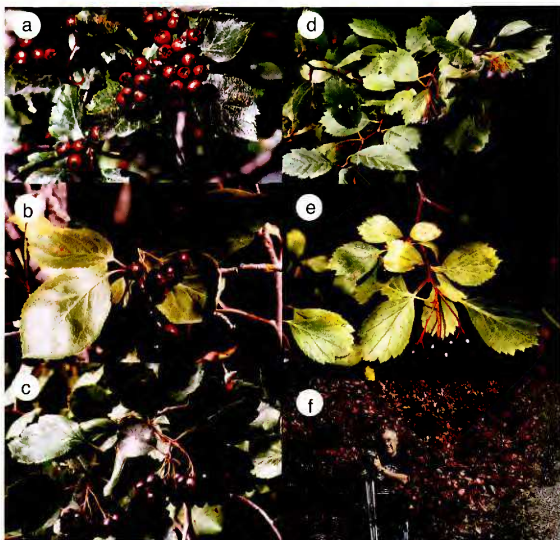


FIG. 4. *Crataegus okennonii* compared with *C. douglasii*: a) *C. okennonii* showing remarkable chestnut-coloured fruit, Kelowna, BC, 18 Aug 1995; b) *C. okennonii*, form with pale foliage, note ampulliform fruit, northern Okanagan, BC, 20 Aug 1995; c) *C. okennonii* with some fruit close to the final purple-black color, northern Okanagan, BC, 19 Aug 1995; d) *C. douglasii* showing full ripe color and a high bloom, northern Okanagan, BC, 19 Aug 1995; e) full ripe color of *C. douglasii* with ellipsoidal fruit, northern Okanagan, BC, 19 Aug 1995; f) *C. okennonii* showing typical cerise color of full ripe foliage; JBP in foreground; Palmer Lake, Washington State, 28 Sep 1993.

after Robert (Bob) J. O'Kennon whose companionship and critical abilities as a field botanist helped to make this discovery possible. It is intriguing that so widely distributed a taxon, of which we are able to cite 36 specimens, has remained undetected for so long.

Additional specimens examined: CANADA. BRITISH COLUMBIA: Northern Okanagan, Spallumcheen Municipality, Powerhouse Rd., E side, near Stardel Drive, alt. ca. 1350 ft, 50°27'N, 119°09'W, bush, 4.5 m tall, ± erect; fruit deep plum/chestnut, ellipsoid-turbinate, 19 Aug 1995, J.B. Phipps 7164 (UBC, UW/O); Okanagan Valley, Oyama, ca. 0.5 mi E of E end of spit, alt. ca. 1320 ft, 50°07'N, 119°21'W, hedgeline on clay soil, bush 5 m

tall, fruit plum-purple, turbinate, 17 Aug 1995, *J.B. Phipps* 7158 (UWO); Castlegar, Selkirk College grounds, towards bottom of slope beyond beehives, scrubby area, 49°19'N, 117°38'W, alt 950 ft, tree 6 m tall; stamens 5, anthers pale pink, buds forced til 10 May, then 10 stamens seen, 06 May 1994, *J.B. Phipps* 6928 (BRIT, CAN, DAO, TRT, UBC, UWO, US); Okanagan Valley, Westside Rd., ca. 9 mi W of jct. with 97 and ± due opposite Vernon, wooded edges on west of road, 50°15'N, 119°27'W, ca. 1200 ft, tree, 5 m tall, fruit small-ish, bright red-burgundy, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6990 (CAN, TRT, UBC, UWO); Northern Okanagan, Hwy 97, E side, between Westside Rd. and Silver Creek Rd., alt. 1800 ft, equals JBP 6969, beautiful 7 m tree, 50°23'N, 119°17'W, convex light yellow-green foliage, fruit light red, turning to burgundy, roundish, flatter at base, glossy, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6995 (BRIT, UWO); Salmon Arm, large hawthorn pasture just N of railroad and W of central business section, alt. ca. 1900 ft, 50°43'N, 119°16'W; bush, 4.5 m tall, fruit burgundy, locally frequent, (equals JBP 6959); 20 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7027 (CAN, TRT, UBC, UWO); Okanagan Valley, Westside Rd., ca. 9 mi W of jct. with 97 and ± due opposite Vernon on E side of road, fenceline 50°15'N, 119°27'W; 7 m multitrunked tree, fruit burgundy, alt. ca. 1200 ft, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6991 (BRIT, CAN, TRT, UWO); Okanagan Valley, NNE of Vernon at jct. 97/97A, scrubby hillside E side of road, 26 Sep 1993, *J.B. Phipps and R.J. O'Kennon* 6821 (BRIT, UWO). Pass Creek Rd., N of Castlegar, 1.3 mi along, mesic grassy slopes, alt. ca. 1800 ft, 49°19'N, 117°40'W; bush, 4 m tall, fruit reddish-burgundy (somewhat 'chestnut'-ROK), 23 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7056 (TRT, UWO); Castlegar, Selkirk College, path behind beehives towards river edge, open woodland-scrub, alt. 950 ft, 49°19'N, 117°38'W; tree, 20 ft tall, reddish-purple foliage, dark purple, ± round fruit, 20 stamens, 26 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6824 (UWO); Slocan Valley, S of Slocan, above swamp along small road off Hwy. 6 & just N of Perry Siding across river, 49°40'N, 117°30'W; hedges and brushy slopes, alt. 1775 ft, bush 6 m tall, fruit red-burgundy, 22 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7047 (UWO); NNW of Vernon on W side Rd about 2.5–3 km SW of intersection of 97 & 97A, alt. 450 ft, 50°20'N, 119°20'W, back of field on west side of road, bush 5 m tall, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6785 (UWO); Okanagan Valley, Hwy. #97, ca. 2 mi S of Silver Creek Rd. exit, (200 m S of 'road narrows' sign), (100 m S of JBP 6968), 50°23'N, 119°17'W, alt 1800 ft, in cut-over forest, young tree 7 m tall, 11 May 1994, *J.B. Phipps* 6969 (BRIT, TRT, UWO); Okanagan Valley, ca. 8 km NNE of center of Vernon, Pleasant Valley Rd., behind Vowle's residence, hedge at S boundary of Burke's PYO, 50°18'N, 119°14'W, alt. 380 m, dense, broad, mature hedge, dominant species, 3.7 m bush, 10 pink anthers, thorns long for species, 2 May 1994, *J.B. Phipps* 6879 (UWO); Salmon Arm, large hawthorn pasture, just N of railroad and W of central business center; 50°43'N, 119°16'W, alt. 1900 ft, bush, 5 m tall, 10 stamens, pink anthers, 10 May 1994, *J.B. Phipps* 6959 (TRT, UBC, UWO, V); Okanagan Valley, Newport Beach campsite on W side Rd., approx. due NW of Vernon, end of parking lot, S end of camp, 50°20'N, 119°22'W, below trees, alt. 1140 ft, tree 5 m tall, erect habit, burgundy fruit, short thorns, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6988 (BRIT, DAO, UBC, UWO, V); NNE of Vernon, S of jct. of 97 and 97A just N of Baker Hogg Rd., bottom of hill, 50°21'N, 119°15'W, alt. 350 m, 4 m bush, purplish fruit, 23 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6821 (UWO); Okanagan Valley, E side of 97, half mi N of intersection with 97; scrubby slopes with long cleared area, 50°21'N, 119°15'W, most abundant species here, bush 6 m tall, red fruit; 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6999 (UWO); Castlegar, grassy floodplain ENE of Selkirk College, dense hawthorn thickets on banks of old oxbow, alt. 950 m, 49°19'N, 117°38'W, tree, 9 m tall, foliage elliptical, slightly lobed, purple, fruit globose, dark purple, ?=20 stamens, 27 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6827 (CAN, ID, MONTU, TRT, UBC, UWO, US);

Northern Okanagan, ca. 1 mi S of Enderby, gravel driveway to NE starting at Indian Cemetery, alt. 1300 ft, 50°31'N, 119°08'W, bush, 4 m tall, fruit burgundy, only one here, 20 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7006 (UWO).

U.S.A. IDAHO. Idaho Co.: US 12, ca. 10 road mi E of Kooskia, bank at back of field, N side of road, with large hawthorns, 46°07'N, 115°50'W, alt. 1550 ft, tree, 9 m tall, fruit burgundy, 26 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7089 (UWO). MONTANA. Flathead Co.: Few mi E of Columbia Falls, at dead end of Mt. Creek Rd. (off Berne Rd.), on fenceline opposite Shoal 330 sign, 48°22'N, 114°08'W, alt. 3000 ft, bush, 2 m tall, 08 May 1994, *J.B. Phipps* 6935 (UWO). Lake Co.: Route 211, ca. 4 mi S of Ronan, nr. MP 44, at farm entrance, driveway through pasture, near scenic turnout, alt. 3030 ft, 47°28'N, 114°06'W, grove of hawthorns on bank S side of driveway, 20 ft apple-like tree, reddish foliage, black orbicular fruit, 28 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6841 (UWO); Rte. 93, ca. 4 mi S of Ronan, near Milepost 44, near scenic turnout, one of group on S side of farm drive, 47°28'N, 114°06'W, alt. 3030 ft, tree 5 m tall, quite large buds forced 'til 11 May, stamens 10, anthers pink, (equals JBP 6841), 08 May 1994, *J.B. Phipps* 6940 (BRIT, MONTU, TRT, UWO, US). Sanders Co.: Route 200, 30 mi W of 93 on N side of road above Flathead R., in group of hawthorns, alt. 2840 ft, 47°19'N, 114°43'W tree, 11 m tall, ± orbicular, black fruit, 29 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6858 (BRIT, CAN, DAO, MO, UWO, V); Route 200, 50.6 km W of jct. with US 93, group of hawthorns above Flathead R., 47°19'N, 114°43'W, alt. 2840 ft, tree 9 m tall, stamens 10, anthers pale pink, (=JBP & RO'K 6955), 09 May 1994, *J.B. Phipps* 6955 (UWO); Route 200, 25 mi W of 93 on N side of road above Flathead R., in long hawthorn hedge, alt. 2845 ft, 47°19'N, 114°38'W, bush 6 m tall with spheroidal burgundy fruit, 29 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6857 (UWO); Route 200, exactly 42.6 km W of jct. with US 93, long hawthorn hedge, above Flathead River, 47°19'N, 114°38'W, alt. 2840 ft, (equals JBP & RO'K 6857), 09 May 1994, *J.B. Phipps* 6953 (BRIT, MO, MONTU, UWO). WASHINGTON. Ferry Co.: Hwy. 21, ca. 3 km SW of Danville, alt. ca. 500 m, 48°59'N, 118°31'W, marshy roadside with trees and scrub, tree, 7 m tall, fruit burgundy, (*C. douglasii* very common here), 23 Aug 1995, *J.B. Phipps* 7174 (UWO). Okanogan Co.: Chopaka Rd., 3 km directly NW of Palmer Lake, open thicket, low rocky slopes, edge of floodplain, alt. 340 m, 48°56'N, 119°41'W, tree, 5.5 m tall, fruit plum-red to burgundy, 28 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7105 (UBC, UWO, WS); Okanogan Valley, W side road about 7 km N of Tonasket, huge hawthorn stand along riverside, ca. 975 ft, 48°44'N, 119°25'W; bush, 6 m tall, crimson foliage, no fruit, 3 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6865 (UWO); Sinlahekin Valley, ca. 5 mi S of Loomis, in depression near roadside, alt. 450 m, 48°45'N, 119°37'W, bush, 4 m tall, black fruit, 28 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7109 (UWO); ca. 6 km NE of Omak, dense hedges in valley-bottom among farm lands, alt. 250 m, 48°27'N, 119°28'W, dense bush, 4 m tall, fruit red, changing from orange, 28 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7100 (UWO). Whitman Co.: US 195 along Spring Flat Creek few mi S of Colfax at MP 35.3, alt. ca. 775 m, 46°51'N, 117°21'W, tree, 6 m tall, fruit plum-red (some approaching chestnut), group of same, 28 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7099 (UWO); 66 Staley Rd., 1 km NE of Chambers, alt. 775 m, dry roadside, young tree in front yard of Harold Bough, 46°39'N, 117°11'W, bush, 4 m tall, fruit shrivelled, 27 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7096 (UWO).

2. *Crataegus okanaganensis* J.B. Phipps & O'Kennon, sp. nov. (Fig. 5).

TYPE: CANADA. BRITISH COLUMBIA: Rough grass with hawthorns on Hwy. 97 near entrance to Kelowna airport, alt. 1800 ft, equals JBP 6907, bush, 4 m tall, fruit, slightly dull and deep red, ± ellipsoid, 17 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6974 (HOLOTYPE: UWO; ISOTYPES: CAN, TRT, UBC, US).

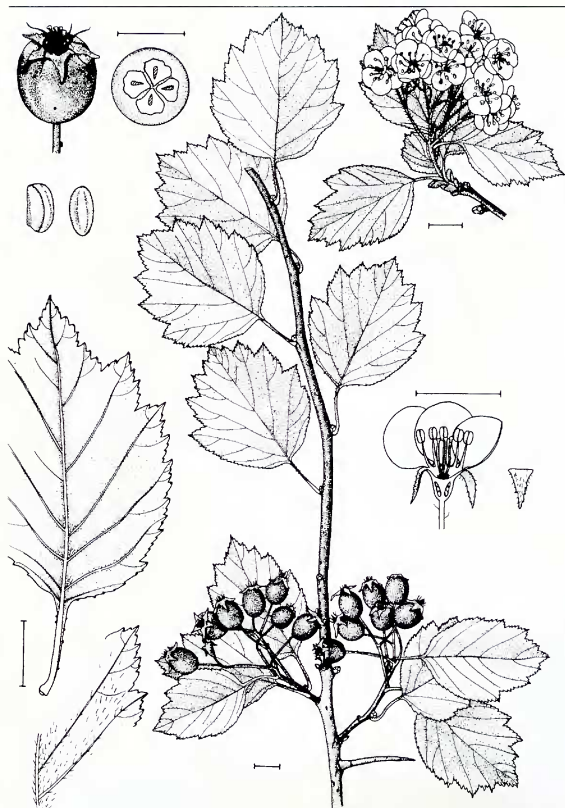


FIG. 5. Line drawing of *C. okanaganensis* J.B. Phipps and O'Kennon. Inflorescence and flower parts from *Phipps* 6929 (UWO); infructescence and fruit parts from *Phipps & O'Kennon* 7002 and 6975 (UWO); and sterile shoot from *Phipps* 6894a (UWO). Scale bars = 1 cm.

Frutex, 3–6 m altus, ramuli unius anni mediocriter brunnei vel atrobrunnei, in juventute sparsim pubescentes; spinae validae, 2–4 cm longae, in juventute nitenter atrobrunneae, recurvatae. Folia decidua, petiolata; petioli 1–2 cm longi, sparsim pubescentes, eglandulares vel cum glandulis nigribus in juventute (Creston); laminae 3.5–6 cm longae, ovatae vel ovato-rhombeae, aliquando late ellipticae vel anguste ovatae, lobis 3–4 ± acutis, marginibus subtiliter dentatis, venis 4–5 per latus, aliquantum impressis supra, in juventute dense appresso-pilosis, pilis attritis in maturitate, subter pubescentes praecipue in venis, coriaceae, super nitentes praesertim in juventute, crescentes rubrae, aeneae in autumnno. Inflorescentia panicula convexa, 10–20 florata; ramuli varie villosi, glandulo-maculati, bracteolis linearibus caducis glandulo-marginatis. Flores 12–15 mm diam., conspicue cupuliformes in juventute; hypanthium externe villosum solo basale vel glabrum omnino; lobi calycis anguste triangulares, 3–4 mm longi, marginibus glandularibus, abaxiale cum pilis paucis; petala ± circularia, alba; stamina 10, antheris albis vel raro pallide roseis; carpelli et styli 2–3(–4). Fructus 8 mm diam., plerumque urceolatus, glaber, coccineus in juventute sed in maturitatem coloris vini vel atropurpureus (raro fere niger), si in conditione bona cum lobis calycis longis insigne erectopatentibus (sed aliquanto brevioribus vel reflexis); pyrenae 2–3, dorsaliter sulcatae, lateribus ± planis, paulo pinguibus vel paulo erosis.

Bush, 3–6 m tall; 1 year old twigs mid to dark brown; young shoots thinly pubescent; thorns stout, 2–4 cm long, shiny deep brown when young, recurved. Foliage deciduous, petiolate; petioles 1–2 cm long, thinly pubescent, eglandular or with small black glands when young (as at Creston, B.C.); blades 3.5–6 cm long, ovate to ovate-rombic, or less commonly broad elliptical to narrow-ovate, with 3–4 sharp lobes per side, margins finely double toothed, 4–5 veins per side, somewhat impressed above, densely appressed hairy when young above, this abrading with age, pubescent principally on the veins beneath, somewhat coriaceous, glossy above especially when young, expanding leaves reddish, the fall colour bronze. Inflorescence a domed panicle, 10–20 flowered, the branches variably villous, gland-dotted, with caducous linear, gland-margined bracteoles. Flowers 12–15 mm diam, notably cup-shaped when young; hypanthium externally villous only at base or completely glabrous; calyx lobes narrow triangular, 3–4 mm long, the margins glandular, abaxially with a few hairs; petals ± circular, white; stamens 10, anthers ivory or occasionally very pale pink; carpels and styles 2–3(–4). Fruit 8 mm diam., generally flask-shaped, glabrous, red when young but later burgundy to deep purple (occasionally almost black), when in good condition with strikingly long erecto-patent calyx lobes but these sometimes shorter or reflexed; nutlets 2–3, dorsally sulcate, their sides flat, a little plump, or shallowly eroded.

Distribution.—Widely distributed and common from the Okanagan valley of southern British Columbia and northern Washington to northern Idaho (Fig. 6). This is an extraordinarily handsome hawthorn in late August and early September.

Crataegus okanaganensis is similar to *C. williamsii* of northwest Montana as illustrated by the numerical analysis (Fig. 1) but with more glossy foliage

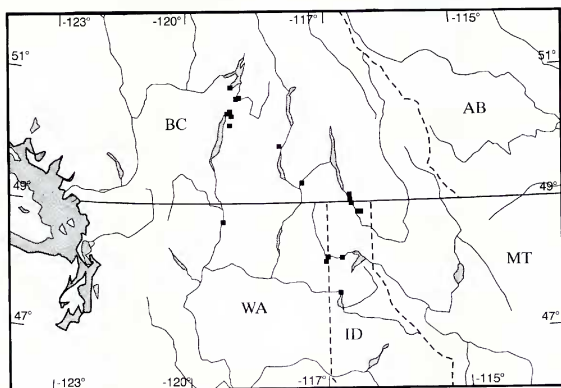


FIG. 6. Distribution of *C. okanaganensis* J.B. Phipps and O'Kennon.

of a much more coriaceous texture and the color usually yellowish-green in mid-season, the blades a little broader and the lobes usually less sharp, thorns generally stouter, different anther color, and mature fruits deep purple (Fig. 9d) instead of sometimes blood or deep red; the young fruit is a brilliant red (Fig. 9e) at the stage when *C. williamsii* may be pale to deeper dull red. The color change from brilliant red (late August) to a deep dull purple (late September) is nearly unique among *Crataegus* species. In northern Idaho at 2300 ft, *C. okanaganensis* flowered in 1994 a good week before *C. williamsii* at the same altitude in northwest Montana. Otherwise identical material with five stamens is occasionally found. *Crataegus okanaganensis* was repeatedly collected in the 1980s in Idaho by Fred Johnson though without recognition.

The two taxa may of ser. *Purpureofructi* be separated as follows:

1. Fresh anthers white or cream; inflorescence branches thinly to moderately hairy; hypanthium usually glabrous; leaves coriaceous (Idaho and west).
..... *C. okanaganensis*
1. Fresh anthers bright pink; inflorescence branches densely hairy; lower part of hypanthium densely hairy; leaves thin (nw Montana).
..... *C. williamsii*

Additional specimens examined: CANADA. BRITISH COLUMBIA: Okanagan Valley, Westside Rd. NW of Vernon, ca. 2 km S of intersection with 97, 1450 ft, hedges on both sides of road, 03 May 1994, Phipps, J.B. 6900 (UWO); ca. 1.2 mi E of Enderby on road to Mabel Lake between 200 m & 25 m W of "Autobody collision & repairs" sign, alt. 1275 ft, hedgerow, bush, 3 m tall, fruit burgundy, 20 Aug 1994, Phipps, J.B. & O'Kennon, R.J. 7016 (UWO); Rough grass with hawthorns on Hwy. 97 near entrance to Kelowna

airport, S side of Airport Dr., alt. 1800 ft, bush 6 m tall, fruit red, slightly deep and dull, \pm ellipsoid, 17 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6975 (UBC, UWO); ca. 8 km NNE of Vernon center at Burke's Pick-your-own on Pleasant Valley Rd., bottom of roadside, 407 m; 5 m bush, dull burgundy, ellipsoid fruit, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6777 (BRIT, MONTU, UWO, WS); Shuswap Valley, just E of Enderby, across bridge, S side of rd. on mound by roadside depression, alt. ca. 1250 ft, bush, 5 m tall, 10 stamens, in bud, 05 May 1994, *Phipps, J.B.* 6912 (UWO); Okanagan Valley, ca. 9 km N of center of Vernon off E side of 97, just S of jct. with 97A & just N of Baker Hogg Road, alt. 350 m, hawthorn thickets to N side of long cleared ride, bush, 5 m tall, 10 white anthers, 03 May 1994, *Phipps, J.B.* 6894 (UWO); Okanagan Valley, ca. 9 km N of center of Vernon off E side of 97, just S of jct. with 97A & just N of Baker Hogg Road, alt. 350 m, hawthorn (mainly) thickets to N side of long cleared ride, bush, 5 m tall, 10 white anthers, 03 May 1994, *Phipps, J.B.* 6894a (UWO); Shuswap Valley, ca. 2.8 km E of Enderby on Kingfisher Rd., on hedgerow S side of road opposite house with wooden fence, N side, alt. 1280 ft, bush, 4 m tall, possibly = JBP & RO'K 6812, foliage somewhat reddish, stamens 10, cream anthers, 05 May 1994, *Phipps, J.B.* 6921 (BRIT, UWO); ca. 1.2 mi E of Enderby on road to Mabel Lake between 200 m & 25 m W of "Autobody collision & repairs" sign, alt. 1275 ft, hedgerow, bush, 5 m tall, fruit reddish burgundy, 20 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7017 (UBC, UWO); Salmon Arm, large hawthorn pasture just N of railroad and W of central business section, alt. ca. 1900 ft, bush, 3.5 m tall, opposite building with blue sstrip, flowers very cup-shaped, anthers 10, very pale pink, 11 May 1994, *Phipps, J.B.* 6966 (BRIT, CAN, UWO); E side of 97A 0.5 mi N of intersection with 97, scrubby slopes with long cleared area, bush, 5 m tall, scarlet fruit, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7000 (UWO); Okanagan Valley, about 8 km NNE of center of Vernon, Pleasant Valley Rd., behind Vowle's residence, hedge at S boundary of Burke's PYO, alt. ca. 380 m, dense, broad mature hedge, bush, 3 m tall, nearest top of hedgerow, 10 anthers, ivory, 02 May 1994, *Phipps, J.B.* 6882 (DAO, UBC, UWO); Castlegar, near Selkirk College, left-hand slope towards bottom of Rosedale Rd., alt. 970 ft, scrubby area, bush 2.5 m tall, prob. = JBP & RO'K 6826, stamens 10, anthers white, 06 May 1994, *Phipps, J.B.* 6929 (BRIT, TRT, UBC, UWO); Okanagan Valley, Westside Rd. NW of Vernon, ca. 2 km S of intersection with 97, 1450 ft, hedges on both sides of road, 03 May 1994, *Phipps, J.B.* 6901 (UWO); Okanagan Valley, west side of hwy. at entrance to Kelowna airport, alt. 1800 ft, open scrub, bush, 4 m tall, stamens 10, anthers ivory to palest pink, 05 May 1994, *Phipps, J.B.* 6907 (BRIT, TRT, UBC, UWO); West side of hwy. 21, just N of, and in view of, Canada Customs post, roadside/forest edge, 2200 ft, tall, 5 m bush, 27 Sep 1993, *J.B. Phipps, J.B. & O'Kennon, R.J.* 6832 (ID, UWO); NNW of Vernon on Westside Rd., ca. 2.5 km SW of intersection of 97 and 97A, hedges along roadside, back of field, W side of rd., bush, 5 m tall with purple shrivelled fruit, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6788 (CAN, TRT, UBC, UWO); E side of hwy. 21, ca. 250 m S of Creston Ferry Rd. to Hood Rd., this species very common here, 1970 ft, dense bush, 3.5 m tall, ellipsoid, burgundy fruit, 27 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6831 (ID, MO, UWO); E side of hwy. 21, immediately S of jct. with BC 3, north of Creston, alt. 1850 ft, scrubby bank, 2.5 m tall bush, fruit shrivelled, black, 27 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6830 (UWO); Castlegar, edge of Campus Rd. off Frank Beinder Rd., grassy slopes with scattered hawthorns, bush, 3 m, lvs sharply lobed, abundant burgundy fruit, 27 Sep 1993; *Phipps, J.B. & O'Kennon, R.J.* 6826 (BRIT, UBC, UWO, US); Larry Calder property, E of 97 about 9 km NNE of Vernon, scrubby partly cleared hillside, 475 m, bush, 4 m, reddish foliage, fruit a good purple, 26 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6819 (UWO); Kalamalka Prov. Park, S of Vernon, within 200 m of yellow gate, at parking lot, dampish depression, ca. 1375 ft,

common, multistemmed bush, fruit oblong-orbicular, burgundy, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6798 (BRIT, UWO); NNW of Vernon on Westside Rd., ca. 2.5–3 km SW of intersection of 97 and 97A, hedges along roadside, back of field, 5 m bush with purple fruit, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6791 (UWO); E side of hwy. 21, immediately S of jct. with BC3, north of Creston, scrubby banks, 1850 ft, 2.5 m bush, leaves green turning purple, ellipsoid, burgundy fruit, 27 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6828 (UWO, V); N of Creston, E side of Hwy. 21, grassy banks with hawthorns on top, just S of junction with Hwy. 3, alt. 1850 ft, bush, 2.5 m tall, stamens 10, anthers white, equals JBP & RO'K 6828, 07 May 1994, *Phipps, J.B.* 6930 (UWO); Salmon Arm, large hawthorn pasture just N of railroad and west of central business section, alt. ca. 1900 ft, bush, 3.5 m tall, fruit bright red, equals JBP 6966, 20 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7024 (BRIT, TRT, UWO); E side of 97A 0.5 mi N of intersection with 97, scrubby slopes with long cleared area, young plant on south side of site, scarlet fruit, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7001 (UWO); E side of 97A 0.5 mi N of intersection with 97, scrubby slopes with long cleared area, young plant on south end of site, scarlet fruit, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7002 (UWO); Hwy. 6 ca. 6 road mi W of Fauquier, west of Arrow Lake in Inookalin Valley, along fenceline in farmland, alfalfa fields, alt. 475 m, bush, 4 m tall, fruit bright red, 22 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7045a (UBC, UWO); Okanagan Valley NNE of Vernon, Pleasant Valley Rd., hedge behind Vowle's residence, E end boundary fence with Burke's P-Y-O, alt. 380 m, bush 3 m tall, fruit large, plump, purple-red, hairy, with stout erect calyx lobes, 19 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 6996 (UBC, UWO); Slocan Valley, S of Slocan, above swamp crossing river along small road off Hwy. 6 & just N of Perry Siding, hedges and brushy slopes, alt. 1775 ft, bush, 5 m tall, fruit bright red, 22 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7048 (UWO); Shuswap Valley, just E of Enderby, across bridge, E side of road, 200 m N of gate, alt. ca. 1250 ft, level open field, growing along roadside across from cattle feeder, 4 m tall, fresh anthers cream, 15 May 1995, *Donovan, L.S. & D.* 2741 (UWO); Shuswap Valley, just E of Enderby, across bridge, E side of road, alt. ca. 1250 ft, level open field, growing along roadside across from cattle feeder, 2.5 m tall, fresh anthers cream, 15 May 1995, *Donovan, L.S. & D.* 2744 (UWO); Okanagan Valley, Kelowna, service road at W side of airport, alt. ca. 1250 ft, fenceline, bush 3 m tall; fruit brilliant red, ellipsoid, 17 Aug 1995, *Phipps, J.B.* 7155 (UWO); Okanagan Valley, Oyama, ca. 0.5 mi E of E end of spit, alt. ca. 1320 ft, hedgeline on clay soil, bush, 4 m tall, fruit ellipsoid, red, 17 Aug 1995, *Phipps, J.B.* 7157 (UWO); Okanagan Valley, Oyama, ca. 0.5 mi E of E end of spit, alt. ca. 1320 ft, hedgeline on clay soil, bush, 4 m tall, fruit ellipsoid, 17 Aug 1995, *Phipps, J.B.* 7159 (UWO).

U.S.A. IDAHO. Bonner Co.: Lower Priest River, river bank, alt. 660 m., scarlet fruit, 07 Aug 1897, *Leiberg, John B.* 2857 (OSC); Pend Oreille R. across from Oldtown, N of bridge, Section 24, T56N, R6W, scrub just above high water mark, dominated by *C. columbiana*, 2000 ft, 07 Aug 1986, *Johnson, Fred* 86126 (IDF); Leclde, Riley Creek, 8 mi E of Priest R. at Pend Oreille R. (Albenai Falls Reservoir) T56N, R3W sec. 30, riparian fringe along reservoir climax forest, gentle slope, common, 12 Aug 1988, *Johnson, F.* 88079 (IDF); Pend Oreille R. across from Oldtown, N of bridge, T56N R6W S24, 2000 ft, shrub fringe just above high water mark, abundant, 07 Aug 1986, *Johnson, Fred* 86126 (ID #93728); 6 mi E of Priest R., along Albenai Falls Reservoir in T56N, R4W sec. 34&35, riparian fringe, 1900 ft, common, 12 Aug 1988, *Johnson, F.* 88082 (IDF); Section 28, T56N, R3W along Pend Oreille R. reservoir, roadside fringe of trees/shrubs by hayfield, many thornless trees, height to 15 ft, 07 Aug 1986, *Johnson, F.* 86124 (ID, IDF). Boundary Co.: US 95, about 5 km S of jct. with Idaho 1 & S of turnout on right below tall conifers, alt. 2250 ft, on E plowed field backed by steep rocky, treed slope, dense bush, 3 m tall, stamens 10, anthers

ivory, 08 May 1994, *Phipps, J.B.* 6932 (ID, UWO); US 95, ca. 5 km S of jct. with Idaho 1 & slightly S of turnout on right below tall conifers, alt. 2250 ft, on E plowed field backed by steep rocky, treed slope, dense bush, 3 m tall, stamens 10, 07 May 1994, *Phipps, J.B.* 6933 (ID, UWO, WS); US 95 2 mi S of jct. with Idaho 1, W side of road, roadside, 27 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6834 (UWO); 2.6 mi S of jct. US 95 & Hwy. 1, in T64N, R1E sec. 28 (SE of Copeland), roadside shrub fringe, 2200 ft, gentle slope, 18 ft tall x 22 ft wide, 5 main stems 3–5, possible escape, no farms near, 12 Aug 1998, *Johnson, F.* 88072 (IDF). Kootenai Co.: floodplain of Spokane R. at Coeur d'Alene, 1/4 mi W of US 95, grassy meadow with scattered trees, no slope, open, 2000 ft, rare with *C. douglasii*, 10 Jun 1982, *Johnson, F.D.* (IDF (#860418)); Spokane River, 1/4 mi E of Washington border, 2100 ft, among granitic rocks and sand, shrubs to 3 m, 01 Aug 1986, *Johnson, F.* 8644 (ID (#93729)); Coeur d'Alene, 20 Jun 1930, *Rust, J.H.* (ID), 20 Jun 1930; floodplain of Spokane R. at Coeur d'Alene, 1/4 mi W of US 95, grassy meadow with scattered tree/shrubs, elev. 2000 ft, 10 Jun 1982, *Johnson, Fred* (ID (#93730)); floodplain of Spokane R., at Coeur d'Alene, 1/4 mi W of US 95, grassy meadow with scattered trees & shrubs, no slope, open, 2000 ft, 16 Jun 1981, *Johnson, F.D.* (IDF). WASHINGTON. Okanogan Co.: Westside Rd. ca. 7 km N of Tonasket, 975 ft, along riverside, 7 m bush, smaller leaves, burgundy fruit, 30 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6868 (UWO); Westside Rd. about 4 km N of Tonasket, alt. 975 ft, bush 5 m tall, riverside hawthorn thicket with a few poplars, fruit ± erect, lake-red, broad-elliptic, 23 Aug 1995, *Phipps, J.B.* 7175 (UWO, WS). Spokane Co.: Spokane, damp places, *Suksdorf, W.N.* 919 (WS), Aug 1889. *Whitman Co.*: Pullman, *Piper, C.V.* (CAS), May 1902; Westend; 1800 ft, spring 1976, *May, R.* 91 (RMV).

ENGLAND: cult. Surrey, Kew, Royal Botanic Gardens; Kew #197-67, 19728; 22 May 1985, *Phipps, J.B.* 5651.

The discovery of *C. okanaganensis* and its clear relationship to *C. williamsii* merit the creation of a new series, as follows:

Series Purpureofructi J.B. Phipps & O'Kennon, ser. nov. TYPE: *C. okanaganensis* J.B. Phipps and O'Kennon.

Frutices, plerumque grandes, vel arbores parvae; spinæ mediocres in longitudine (2–4 cm longae). Folia plerumque ± coriacea (praeter *C. williamsii*), laminae plerumque ± rhombæae, (vel elliptico-oblongae vel rhombo-ovatae), plerumque lobis 3–4 brevibus patentibus per latus. Inflorescentia 10–25 florata. Flores mediocres (10–15 mm) diam; stamina 5–10; carpelli et styli 2–4. Fructus coccineus, plerumque clare coccineus in Augusto exeunte, in maturitate Septembri exeunte fierens sanguineus vel atropurpureus, orbicularis vel ampulliformis; pyrenis 3–4, lateribus erosis vel planis.

Bushes, usually large, to small trees; thorns medium in length (2–4 cm). Leaves generally ± coriaceous (except *C. williamsii*), blades usually ± rhombic (to elliptic-oblong or rhomb-ovate), usually with 3–4 short outward-pointing lobes per side. Inflorescences 10–25 flowered; flowers not large (10–15 mm diam.); stamens 5–10; carpels and styles 2–4. Fruit red, usually brilliant red in late August, becoming deep blood-red to dark purple at maturity, orbicular to flask shaped; pyrenes 3–4, sides eroded or plane.

Distribution.—A distinctive series with two known species and perhaps a couple of others found from the interior Pacific Northwest and southern British Columbia to northwestern Montana. *Crataegus williamsii* was origi-

nally placed in series *Rotundifoliae* by Eggleston but the ellipsoid fruit, long calyx lobes in fruit, dark-colored twigs and somewhat erose nutlets suggest a different affinity. Our numerical analysis (Fig. 1) indicates no relationship whatever to *C. chrysocarpa* in ser. *Rotundifoliae*.

3. *Crataegus phippsii* O'Kennon, sp. nov. (Fig. 7). TYPE: CANADA. BRITISH COLUMBIA: Okanagan Valley, Pleasant Valley Rd., ca. 8 km NNE of Vernon center, bush, 4 m tall, fruit red, 24 Sep 1993, *Phipps, J.B. and O'Kennon, R.J.* 6780 (HOLOTYPE: UWO; ISOTYPES: BRIT, CAN, TRT, US, WS).

Arbor vel frutex magnus, 5–6(–7) m alta, trunco uno dominante sed aliquanto cum surculis; ramuli unius anni atropurpurei/-brunnei, veteres atrocinere; in juventute dense et breviter pubescens; spinae aliquantum sparsae, atrobrunneae vel nigrae, leviter recurvatae, aliquantum tenues, 2–4 cm. longae. Folia decidua, petiolata; petioli 1.5–2.0 cm longi, pubescentes; laminae 4–8 cm longae (sed ad 10 cm vel plus in blasis elongationis), late ellipticae vel ovatae vel deltoideo-ovatae, lobis fere 3 ± vadositer obtusis vel late angulatis per latus, marginibus breve dentatis; ca. 4 (–5) venis secundariis per latus, supra breviter appresso-pubescentes subter breviter pubescentes praecipue in venis, aliquantum coriaceae postea. Inflorescentia panicula depressa, 6–12 florata; ramuli dense breviter-tomentosi, bracteolati; bracteoli lineares glandulo-marginati. Flores 15–22 mm diam.; hypanthium externe breviter tomentosum; lobi calycis late triangulares, ca. 5 mm longi, abaxiale pubescentes praecipue proximale, marginibus glandulo-laciniatis; petala ± circularia; stamina 10, antheris roseis pallide; styli carpellique 2–4, stigmatibus capitatis. Fructus 12 mm diam., breve-pubescentes, maturentes ab coccineo ad pruneo-purpureum vel nigrum, ± orbiculares vel late urceolati, lobis calycis reflexis; pyrenae 3, vadositer sulcatae dorsale, lateribus planis.

Tree or large bush, 5–6(–7) m tall, with main trunk, but sometimes suckering; 1 year old twigs dark purple-brown, older dark gray, young shoots densely short pubescent; thorns somewhat sparse, deep brown to black, slightly recurved, somewhat thin, 2–4 cm long. Foliage deciduous, petiolate; petioles 1.5–2.0 cm long, pubescent; blades 4–8 cm long (but on shoots of elongation to 10 cm or more), broadly elliptic to ovate or broad deltoid-ovate, with about 3 ± shallow rounded to broadly angled lobes per side, the margins short-dentate; about 4–5 secondary veins per side, shortly appressed hairy above, shortly hairy especially along the veins below, somewhat coriaceous later. Inflorescence a 6–12-flowered flattened panicle, the branches densely short-tomentose, bracteolate, the bracteoles linear, gland-margined. Flowers 15–22 mm diam; hypanthium externally densely tomentose; calyx lobes broad-triangular, ca. 5 mm long, pubescent abaxially, especially below, the margins glandular-laciniate; petals ± circular; stamens 10, anthers pale pink; inside of hypanthial cup mostly glabrous, bristly at center; carpels and styles 2–4, the stigmas capitate. Fruit 12 mm diam., short-hairy, ripening through shades of red to plum-purple to black in colour, ± orbicular to broadly flask-shaped, pubescent, with reflexed calyx lobes; nutlets 3, shallowly dorsally ridged, lateral walls ± plane.

Distribution.—This species is not so common as the other two described

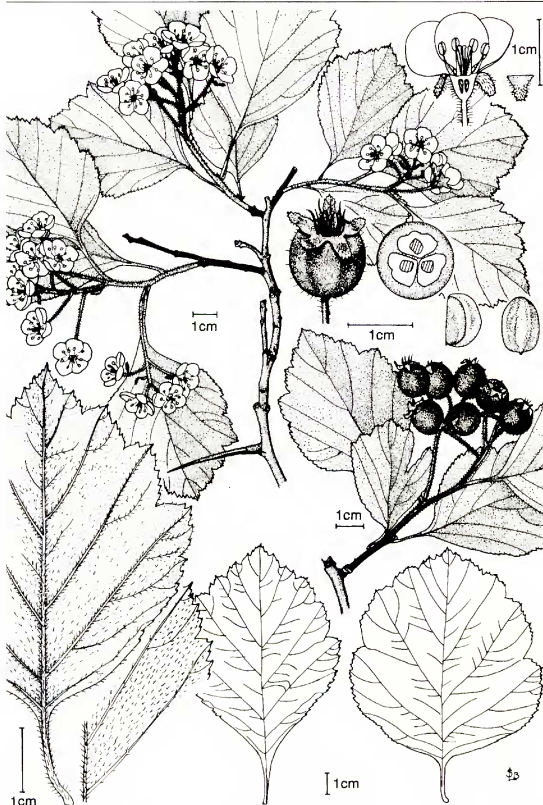


FIG. 7. Line drawing of *C. phippsii* O'Kennon. Inflorescence flowers and parts from *Phipps* 6891 (UWO); infructescence, fruit and parts from *Phipps* 6780 and O'Kennon (UWO); two smaller isolated leaves from *Phipps* 6780 and O'Kennon (UWO); magnified leaf (bottom left) from *Phipps* 6891 (UWO). Scale bars = 1 cm.

in this paper but is nevertheless widespread and has been found at fourteen localities ranging from the Okanagan Valley of southern British Columbia and northern Washington to the Flathead Valley of Montana (Fig. 8). We have never found it numerous at any site.

Crataegus phippsii is one of the most distinctive species of hawthorn to have been found in North America in recent decades and does not appear to be closely similar to any other known in the west, a feature emphasized in Figure 1. It is a large hawthorn, reminiscent of *C. mollis*, the latter a common species of the interior of the continent, in foliage, habit and pubescence while in its red (Fig. 9a) changing to purple (Fig. 9b) to black fruit it is similar to a number of mostly previously undescribed species of the Pacific Northwest and British Columbia. The foliage colours attractively in autumn (Fig. 9b, 9f). The mature bark sometimes flakes off in longitudinal strips, an unusual feature in hawthorns (Fig. 9c).

Crataegus phippsii was first collected by B.T. Butler (nos. 521–523) in 1908 and these specimens were cited by Eggleston (1909) in his protologue for *C. williamsii*. The many differences from *C. williamsii*, however, show that *C. phippsii* is not in this affinity. That Eggleston thought it somewhat distinct is shown by his annotations on the sheets of "var. *ovata*," a name, however, never published. Beyond this brief glimpse of notoriety, the present species, very striking to the present authors, remained totally overlooked until our collections of recent years.

The large, broad leaves with rounded lobes and hairiness of all parts suggests an affinity with series *Molles*. Superficially, it most nearly resembles the local species *C. noelensis* Sarg. of Missouri, a taxon which, however, has not been seen for many years. A combination of stamen number, anther color, foliage size and shape, and fruit color are the main characters distinguishing the species in the *Molles* group as shown in the following key. For convenience, I am including *C. greggiana* in this key although it is now placed in ser. *Greggianae*.

KEY TO *C. PHIPPSII* AND MEMBERS OF SERIES *MOLLES*

1. Foliage small, on short shoots mainly 4 cm long.
 2. Flowers 1–1.5 cm diam.; stamens usually 10. *C. greggiana*
 2. Flowers ca. 2 cm diam.; stamens 20. *C. lanuginosa*
1. Foliage larger, on short shoots generally 5–8 cm long.
 3. Anthers pink.
 4. Stamens 5–10.
 5. Fully ripe fruit orange-red; leaves ± unlobed. *C. noelensis*
 5. Fully ripe fruit deep purple to black; leaves evidently lobed. *C. phippsii*
 4. Stamens 20.
 6. Fruit red. *C. texana*
 6. Fruit yellow. *C. viburnifolia*, *C. kelloggii*
 3. Anthers white to cream.

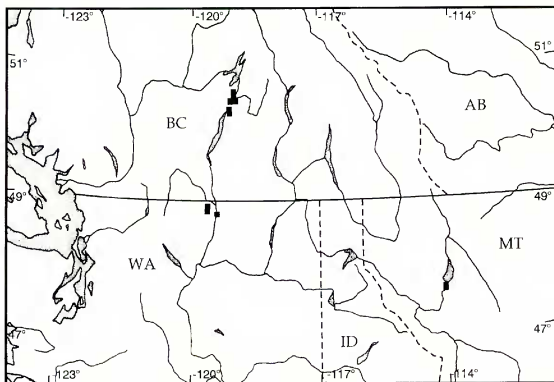


FIG. 8. Distribution map of *C. phippsii* O'Kennon.

7. Stamens 20. *C. mollis*
 7. Stamens 10. *C. submollis*, sens. lat.

Additional Specimens examined: CANADA. BRITISH COLUMBIA: Okanagan Valley, 8 km NNE of center of Vernon, Pleasant Valley Rd., behind Vowle's residence, hedge at S boundary of Burke's PYO, dense, broad mature hedgeline, bush 4 m, commencing flowering, 7-8 pale pink anthers, 02 May 1994, *Phipps, J.B.* 6878 (BRIT, CAN, TRT, UBC, UWO, US); Okanagan Valley, 8 km NNE of center of Vernon, Pleasant Valley Rd., behind Vowle's residence, hedge at S boundary of Burke's PYO, dense, broad mature hedgeline, bush 4 m, foliage glossy, pedicels hairy, 10 pink anthers, 02 May 1994, *Phipps, J.B.* 6880 (CAN, TRT, UBC, UWO); Okanagan Valley, rough, scrubby slope above dirt road NW-bound into O'Keefe Ranch, opposite L. & A. Cross Rd. off 97A, alt. 1290 ft a.s.l., stamens 10, anthers light pink, equals JBP & RO'K 6803, 03 May 1994, *Phipps, J.B.* 6891 (UBC, UWO, WS); ca. 10 km N of Vernon center, on dirt road N-bound into O'Keefe Ranch off Hwy. 97A at L. & A. Cross Rd., dry rocky hillside, suckering clump of trees to 5 m, 25 ft across, bark coarse, plated, peeling, fruit purple, 25 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6803 (CAN, UWO); Pleasant Valley Rd. ca. 8 km NNE of Vernon Center, southern boundary hedge of Burke's PYO behind Vowles' residence, alt. ca. 380 m, dense, broad mature hedgeline of *Crataegus*, bush 4 m tall, fruit deep red, 24 Sep 1993, *Phipps, J.B. & O'Kennon, R.J.* 6780 (BRIT, CAN, MO, UWO); ca. 5 km NNE of Enderby, on E-W rd. between Shuswap R. and Hwy. 97A, long hedgerows, alt. ca. 1375 ft, bush, 5 m tall, fruit red, 21 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7038 (UWO); ca. 3 km NE of Enderby on road to Sicamous (Hwy. 97A), bottom of scrubby slope on east side, alt. ca. 1400 ft, clump of 5 m bushes, reddish fruit, 21 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7037 (DAO, UWO); ca. 5 km ENE of Armstrong on E-W aligned rd. just ENE of Armstrong airport, hedgerows, S side of road, alt. 1450 ft, bush 5 m tall, 21 Aug 1994, *Phipps, J.B. & O'Kennon, R.J.* 7041

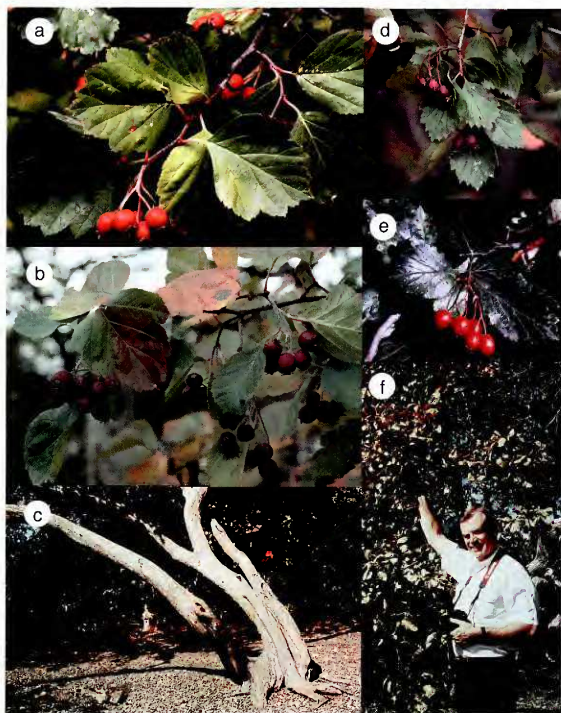


FIG. 9. Various pictures of *C. phippsii* O'Kennon and *C. okanaganensis* J.B. Phipps & O'Kennon: a) typical reddish late August fruit color of *C. phippsii*, northern Okanagan, BC, 19 Aug 1995; b) typical later September fruit color of *C. phippsii* with fall foliage color beginning, northern Okanagan, BC, 24 Sep 1993; c) trunks of *C. phippsii* showing shredding bark, shores of Palmer Lake, Washington, late Aug. 1994; d) full ripe fruit color of *C. okanaganensis*, Westside Rd., nr. Vernon, BC, 24 Sep 1993; e) late August fruit color of *C. okanaganensis*, nr. Kelowna, BC, 17 Aug 1995; f) R.J. O'Kennon holding fruiting branch, Palmer Lake, Okanagan Co., WA, 01 Oct 1993; note fall foliage.

(UWO); ca. 6 km N of Armstrong, branch of Deep Creek, thickets, primarily *C. douglasii*, in narrow flood-plain, alt. 1450 ft, tree 4 m tall, fruit red, 21 Aug 1994, *Phipps, J.B. & O'Kennon, R.J. 7034a* (UWO); ca. 3 km NW of Armstrong, N-S road parallel to Schubert Rd. and to the W of it, E side, alone by telephone pole, alt. ca. 1400 ft a.s.l., bush 3.5 m tall, dark green leaves, dull reddish fruit, 21 Aug 1994, *Phipps, J.B. & O'Kennon, R.J. 7033* (BRIT, UBC, UWO).

U.S.A. MONTANA. Flathead Co.: about 0.5 km along Tower Rd. off US 93, near SW corner of Flathead Lake, hawthorn thicket along trail, rear of small field, alt. 2950 ft, equals JBP 7078, bush 7 m tall, overtopping all others, at popcorn, anthers pink, 20 May 1997, *Phipps, J.B. & O'Kennon, R.J. 7591* (MONTU, UWO). Lake Co.: Hwy. 93, mipost 63.4, Tower Rd., (major pabillio), 2.0 mi. NW of Polson Bridge, 8–(11–12)–14 flowers, 10 pink anthers, leaves hairy, shaggy, in green bud stage (forced), 18 May 1995, *O'Kennon, R.J. 13156* (UWO); Flathead Lake, SW border, 29 Aug 1908, *Butler, B.T. 522* (NY); Rocky Point Road NW of Polson at 1.7 mi N of hwy 93 and 0.3 mi NE of Jim's Road, alt. 2920 ft, extensive thickets near lakeshore behind new housing, bush, 5 m tall, fruit orbicular, reddening, 25 Aug 1994, *Phipps, J.B. & O'Kennon, R.J. 7080* (BRIT, ID, MO, MONTU, UWO); Flathead Lake, SW border, 19 Aug 1908, *Butler, B.T. 523* (NY); Flathead Lane, off Tower Rd., off hwy 93 few mi NW of Polson, thickets along creek back of field, alt. 3050 ft, tree 5 m tall, fruit partly deep oxblood, partly paler, 25 Aug 1994; *Phipps, J.B. & O'Kennon, R.J. 7078* (DAO, MONTU, UWO, US); Flathead Lake, SW border, 19 Aug 1908, *Butler, B.T. 521* (NY). WASHINGTON: Okanogan Co.: Palmer Lake, N side., open hawthorn thicker at upper level of pebble beach at picnic spot/campsite, just E of Chopata Lodge, small tree, 6 m tall, mostly finished flowering, stamens 10, anthers pale pink in bud, =JBP & RO'K 6874, 04 May 1994, *Phipps, J.B. 6904* (ID, MO, UWO, WS); W of US 97 on crossroad at Ellisford, in floodplain to S side of road, bush, 7 m tall, anthers 10, pale pink, equals JBP & RO'K 6876, 04 May 1994, *Phipps, J.B. 6906* (US, UWO, WS); Palmer Lake, N side, open hawthorn thicket at upper beach level on campsite just E of Chopata Lodge, alt. 1150 ft, fine tree, 7 m tall, burgundy fruit; 30 Sep 1993, *Phipps, J.B. & O'Kennon, R.J. 6874* (DAO, ID, MO, UWO, WS); E shores of Palmer Lake, 0.7 mi S of campsite at N end, thickets, alt. 355 m, bush, 4.5 m tall, deep plum-red fruit, 28 Aug 1994, *Phipps, J.B. & O'Kennon, R.J. 7108* (BRIT, ID, UWO, WS); Okanogan Valley, cross-road at Ellisford, alt. 950 ft, bush 7 m tall in field in floodplain, S side of road, fruit blackish, 01 Oct 1993, *Phipps, J.B. & O'Kennon, R.J. 6876* (UWO, WS).

ACKNOWLEDGMENTS

We wish to thank the National Research Council of Canada for supporting this research, Susan Laurie-Bourque of Hull, Quebec for the line illustrations and Antony Littlewood of the Department of Classical Studies, The University of Western Ontario, for checking the Latin diagnoses. Peter Wood of Selkirk College, Castlegar is thanked for field assistance. J.B. Phipps thanks R.J. O'Kennon for supporting the color printing.

REFERENCES

- EGGLESTON, W.W. 1909. New North American *Crataegi*. Bull. Torrey. Bot. Club 36:639–642.
 HOLMGREN, N.H. 1997. Rosaceae. In: A. Cronquist, et al., eds. Intermountain Flora, vol. 3A. New York Botanical Garden, Bronx.
 PHIPPS, J.B. 199x. Taxonomic and nomenclatural problems in black and burgundy-fruited *Crataegus* (Rosaceae) species: *C. erythropoda*, *C. rivularis* and *C. saligna*. Sida, submitted.

- PHIPPS, J.B. 1998. Introduction to the red-fruited hawthorns (*Crataegus*, Rosaceae) of western North America. *Canad. J. Bot.* 76(in press).
- SARGENT, C.S. 1907. The black-fruited hawthorns of western North America. *Bot. Gaz.* 44:64–66.
- WELSH, S.L. 1987. Rosaceae. In: *A Utah Flora*. Great Basin Naturalist Mem. 9:520–543.